PROBLEMS.

29. Proposed by R. H. YOUNG, West Sunbury, Pennsylvania.

An interest bearing note dated Aug. 1st, 1892, was discounted at 90 days at 8%. The face of the note was $750, and the proceeds $759.982. What was the date of discount?

30. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

While dressing a fifty-cent chicken, a poulterer found a fifty-dollar diamond in the chicken's gizzard. He sold the chicken at a profit of 25cts., changed with good money the counterfeit ten-dollar bill handed him by the unknown purchaser, and realized 50% of the estimated value of the diamond. What per cent. of gain, or loss, did the poulterer make? Suppose the purchaser of the chicken and of the diamond had been one person, what per cent. of gain, or loss, would *he* have made after selling the diamond for $25 in good money?

31. Proposed by I L. BEVERAGE, Monterey, Virginia.

"A man wishes to know how many hogs at $9, sheep at $2, lambs at $1, and calves at $9 per head, can be bought for $400,having of the four kinds, 100 animals in all. How many different answers can be given ?"

[Satisfactory arithmetical solution desired.]

32. Proposed by P. C. Cullen, Mead, Nebraska.

A horse is tied to corner of building 40 feet square, by a rope 110 feet long. Over how much land can he graze ?

Solutions to these problems should be received on or before November 1st.

ALGEBRA.

Conducted by J. M. Colaw, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

21. Proposed by Professor J. F. W. SCHEFFER, A. M., Hagerstown, Maryland.

A tobacconist has two kinds of smoking tobacco, of which the price of the better kind is $1 and of the inferior $.75 per lb. Now, he takes 9 parts of the better and mixes it with two parts of the inferior, then 9 parts of the mixture with two parts of the inferior, etc. What is the price of the *n*th mixture per lb.?

I. Solution by H. C. WHITAKER, B. S., M. E., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania, and P. H. PHILBRICK, M. S., C. E., Lake Charles, Louisiana.

The portion of the better in the first mixture was $\frac{9}{11}$, in the second mixture was $(\frac{9}{11})^2$, and in the nth mixture was $(\frac{9}{11})^n$, making the portion of

the inferior to be $1-(\frac{9}{11})^n$. The answer is, therefore, $(\frac{9}{11})^n+\frac{3}{4}[1-(\frac{9}{11})^n]=\frac{3}{4}+\frac{1}{4}(\frac{9}{11})^n$ dollars.

II. Solution by A. L. FOOTE, C. E., Merrick, New York.

Let $a=$(\$1.) price of better kind, and $b=$(75cts.) price of the inferior kind per lb. Then, the value of 1lb. after first mixture is, $a(\frac{9}{11})+b(\frac{2}{11})$; after the second, $[a(\frac{9}{11})+b(\frac{2}{11})]\frac{9}{11}+b(\frac{2}{11})=a(\frac{9}{11})^2+b(\frac{2}{11})(\frac{9}{11}+1)$; after the third, $a(\frac{9}{11})^3+\frac{2b}{11}[(\frac{9}{11})^2+(\frac{9}{11})+1]$, etc., etc.; and after the nth mixture, $a\,(\frac{9}{11})^n+\frac{2b}{11}[(\frac{9}{11})^{n-1}+(\frac{9}{11})^{n-2}+\dots\dots+1]$.

The sum of the series of which $\frac{2b}{11}$ is a factor is $b-b(\frac{9}{11})^n$, and the entire value is $b+(\frac{9}{11})^n(a-b)=\frac{3}{4}+\frac{1}{4}\,(\frac{9}{11})^n$ dollars.

III. Solution by the PROPOSER.

By Finite Differences. Let $f(x)$ be the price per lb. of the xth mixture, then $\frac{9}{11}f(x)+\frac{2}{11}\times 75$ will be the price for the $(x+1)^{th}$. $\therefore f(x+1)=\frac{9}{11}f(x)+\frac{150}{11}$. Solving we get, $f(x)=75+C(\frac{9}{11})^x$. For $x=0$, $f(x)=100$, $\therefore$ 25, and $f(x)=75+25\,(\frac{9}{11})^x$, [or as above $\frac{3}{4}+\frac{1}{4}\,(\frac{9}{11})^n$ dollars.]

Also solved by *J. H. DRUMMOND, J. K. ELLWOOD, F. P. MATZ*, and *G. B. M. ZERR*.

22. Proposed by F. P. MATZ, M. A., M. Sc., Ph. D., Editor of the Department of Mathematics in the "New England Journal of Education" and Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

For the sum $D=$\$30, Messrs. Zerr and Ellwood contracted to plough the sod for a circular track, width, $m=60$ feet and inner radius $r=940$ feet. How is the money to be divided, if they commence ploughing at the inner circumference of the track, make uniform furrows of width $n=1\frac{1}{3}$ feet, and Mr. Ellwood continually follows Mr. Zerr during the ploughing?

Solution by J. K. ELLWOOD, A. M., Pittsburg, Pennsylvania; M. A. GRUBER, A. M., Washington, D. C.; A. H. BELL, Hillsboro, Illinois; J. H. DRUMMOND, LL. D., Portland, Maine; and P. S. BERG, Apple Creek, Ohio.

$\frac{m}{n}=\frac{60}{1\frac{1}{3}}=45$ rounds; as Mr. Zerr begins, he plows 23 furrows and Mr. Ellwood 22 furrows.

Now, $\pi\,(r+n)^2-\pi n^2=\pi n(2r+n)$, the surface of Z's 1st furrow.

His next furrow is represented by $\pi\,(r+3n)^2-\pi(r+2n)^2=\pi n(2r+5n)$, and so on, each furrow having just $4\pi n^2$ more surface than the next preceding. Hence, we have an arithmetical progression, whose first term is $\pi n(2r+n)$, com. diff. $4\pi n^2$, and number of terms 23. $\therefore$ The area of Z's rounds is $\pi(r+n)^2-\pi r^2+\pi(r+3n)^2-\pi(r+2n)^2+\dots\dots+\pi(r+45n)^2-\pi(r+44n)^2$, or $\pi n(2r+n)+\pi n(2r+5n)+\pi n(2r+9n)+\dots+\pi n(2r+89n)$, or $23\pi n(2r+45n)$.

Evidently, the area of E's rounds is $\pi(r+2n)^2-\pi(r+n)^2+\pi(r+4n)^2-\pi(r+3n)^2+\dots\dots+\pi(r+44n)^2-\pi(r+43n)^2$, or $\pi n(2r+3n)+\pi n(2r+7n)+\pi n(2r+11n)+\dots\dots+\pi n(2r+87n)$, or $22\pi n(2r+45n)$.

Hence, Z's portion of $D=$\$30 : E's portion $=23\pi n(2r+45n):22\pi n(2r+45n),=23:22$.